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The relationship between linguistic behavior and diagnostic classifications in the language processing systems of bilingual schizophrenics

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THE RELATIONSHIP BETWEEN LINGUISTIC BEHAVIOR AND DIAGNOSTIC CLASSIFICATIONS IN THE LANGUAGE PROCESSING SYSTEMS OF BILINGUAL SCHIZOPHRENICS

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Introduction

The study of language in schizophrenia has traditionally emphasized its importance as a criterion variable in diagnosis and treatment. Yet, since language qualifies as behavior which can be recorded and divided into discrete measurable units, it serves also as a variable which can be experimentally manipulated and observed to investigate the nature of the schizophrenic disorder in general. Many authors have pointed out that schizophrenic thought disturbances are expressed, at least in part, in the deviant language patterns so often manifested in that psychopathological syndrome (e.g., Cromwell & Dokecki, 1968; Kasanin, 1944; Pearl, 1963; Vetter, 1968). Language studies such as those cited by Pavy (1968) and Vetter (1968) have contributed increasingly to the understanding of etiological and pathogenic factors in schizophrenia by calling attention to the findings of modern linguistic research and theory which are applicable to the psychopathological field. Vetter (1968) stressed the need for a reappraisal of language phenomena in terms of verbal behavior *per se* rather than solely as responses symptomatic of an underlying abnormal condition.

Additionally, from the standpoint of a comparative psychology of language, Jones and Wepman (1965) advanced the following premise in their study of aphasia: "By determining the communication processes that are differentially affected by brain damage, we become aware of language processes that must contribute to the language skills of the normally functioning person [pp. 237-38]." If the words "thought disturbances" are substituted for "brain damage" in this quotation, then, in a similar manner, research with schizophrenics about the effects of delusions and hallucinations can lead to general principles of normal language organization and processing.

From one point of view, the schizophrenic patient uses language as a means of coding or transforming inwardly experienced events and the perception of reality into idiosyncratic systems of signs and symbols (Lorenz, 1968). If this orientation is accepted, then a psycholinguistic model of schizophrenic language might serve to partially explain the processes operating in schizophrenia. Pavy (1968) argued that such aspects of language structure as the number and kind of different grammatical transformations affect perception and might differentiate between schizophrenics and normals. He recommended that the psychologist, within the framework of a theory of general linguistic competence, must consider a performance model of the actual production and perception of a speaker. This model, in accounting for the interaction of linguistic behavior with language structure, might be used to explain more fully the nature of the schizophrenic process. In addition, a comparison of performance models of schizophrenic and normal language skills could differentiate more generally between degrees of schizophrenic and normal behavior. Although such a model, to be described later, has been proposed for aphasia (Jones & Wepman, 1965), an organic disorder, similar efforts have been neglected in functional psychopathology.

An alternative, yet somewhat complementary, approach to the study of language is that of the behavioral psychologist. This view focuses on the use of learning theory, especially the operant conditioning paradigm, in explaining language acquisition and performance. In Skinner's (1957) formulation verbal behavior of a speaker or hearer is accounted for in terms of selective reinforcement and extinction of appropriate and inappropriate responses, respectively. His mechanistic stimulus-response-reward paradigm does not make provision for any covert intervening variables to explain "meaning"; the "meanings" of the linguistic forms that happen to be involved in verbal responses can be completely accounted for by stating the contingencies under which the verbal responses occur. The meaning relationship lies wholly in behavior, that is, in the conditioned response evoked by a language sign (stimulus). Groups of responses are organized into sets of associations, or concepts, which are linked with the properties of stimulation that are specific to a particular linguistic form in the speech community.

Both of these theoretical positions -- the linguistic and the behavioristic -- are introduced here as parallel structures within which a study of language can proceed. As this study is developed, each strand is evident to some extent, with a synthesis of the two evolving in a psycholinguistic model which characterizes actual language use. This model, with the addition of a bilingual dimension, is then discussed in light of schizophrenic language deviations.

To return to the Jones and Wepman (1965) psycholinguistic model mentioned earlier, these authors have conceptualized a scheme of the major components of language skills involving speech in a hypothesized series of perceptual processors or stimulus recognizers whose functions remain specific to a given sensory modality. As illustrated in Figure 1, the kinesthetic processor (mouth and larynx) is connected to the acoustic processor (ear). The information processed at the kinesthetic level is passed on to the acoustic level, and the cumulative information processed at this second level is then carried to the visual processor (eye) where the third sensory component is added to the processing system. Between each of the sensory processors there is some interaction occurring, and each one begins to function at a different point as the child progresses through various stages of speech development. The kinesthetic processor functions in the babbling stage; the acoustic processor functions as the child begins to imitate outside stimuli; the visual processor comes into action as the child begins to vocalize about the objects which are visually presented to him.

These receptor systems do not abstract "meaning" from the stimuli. As stimulus recognizers in interaction with memory,

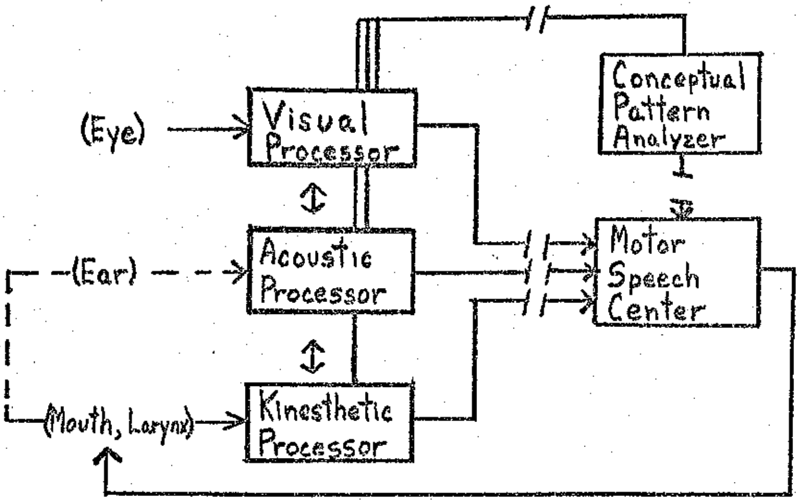

Fig. 1. Schema of language processing units involved in speech. (Note.—- Diagram reproduced from an article by Lyle Jones and Joseph Wepman in S. Rosenberg [Ed.], Directions in Psycholinguistics, 1965, p. 248.)

their psychological function parallels that which is commonly attributed to secondary sensory association areas of the cerebral cortex; that is, they serve an integrative function for the neural impulses transmitted from the various sensory mechanisms. The cumulative result of the three sensory processors then proceeds to the conceptual pattern analyzer where the comprehension of language symbols takes place; here, memory and past experience integrate the sequential outcome from all of the sense modalities into a percept, so that the physical symbols are stripped of their sensory origin. The perception that is formulated here is relayed to the motor speech center which is responsible for the motor response given through the mouth and larynx of the kinesthetic processor.

In this intra-individual model the authors indicated five functional "breaks" in the transmission channels which can be equated to forms of disturbance found in aphasic patients. Similar breaks can be postulated to account for schizophrenic language disorders. Specifically, a break in the flow from the motor speech center to the kinesthetic processor could account for word salad, a syntactic disorder. A break between the acoustic and visual processors could account for a defect in attention, a general defect in selection and elimination of competing terms (Cromwell & Dokecki, 1968; Lawson, McGhie, & Chapman, 1964). A break between the visual processor and the conceptual pattern analyzer might account for the majority of the defects occurring in schizophrenic language behavior, since it is the resultant of the three sensory modalities which goes through this transmission channel. According to Vetter (1968), these defects include misinterpretation in favor of the stronger meaning response, often referred to as Chapman's primacy bias (Pavy, 1968); uncommon word associations; idiosyncratic contexts and symbol-referent relationships; and confusions of meaning ranging from condensations of multiple meanings to literal misinterpretation of word meanings.

One specific question, and the focus of this study, concerns the influence of bilingualism on verbal stimulus processing in schizophrenia. Mackey (1962) described bilingualism as "the alternate use of two or more languages by the same individual [p. 63]." Macnamara's (1967) expansion of this definition considers bilingualism to be a series of continua which vary among individuals with respect to the degree of facility in each of the four major language skills: speaking, listening, reading, and writing. In addition, Ervin and Osgood (1954) advanced the notion that two distinctive forms of bilingualism would result, depending upon the cultural contexts in which the languages were acquired. They proposed that the compound bilingual possessed two sets of equivalent signs (one in each language) for the same class of referents, thereby attributing identical meanings to corresponding words and expressions in his two languages, which resulted from having learned both languages at the same time in the same context (e.g., a bilingual home). In contrast, the coordinate bilingual derived different or partially different meanings from corresponding expressions in the two languages, arising from the acquisition contexts being culturally, temporally, or functionally separated (e.g., Spanish in Spain and English in the United States). The actual referents of the translation equivalents in the two languages might not necessarily be the same. Furthermore, it was suggested that the language acquisition context would determine differences between these groups in the manner in which they structured and stored the semantic content of their languages. This distinction is considered later as it relates to the language acquisition history of bilingual schizophrenics.

In addressing himself to the relationship between language and thought in schizophrenia, the learning-oriented theorist and the psycholinguist may be particularly attracted to bilingualism because the nature of the schizophrenic language defect may be more clearly evident in a bilingual framework; theoretically, any language differences existing in schizophrenic patients classified according to premorbid adjustment, chronicity, and paranoia (Pearl, 1963; Rabin & Winder, 1969; Storms, Broen, & Levin, 1967) might be exaggerated in schizophrenics who are also bilingual, since the bilingual is potentially a more sensitive subject linguistically. Perhaps, for example, one of the two language systems is more reactive in the presence of schizophrenic processes because it is more recently learned and, therefore, less well established in the behavioral hierarchy. Or, in considering whether the breakdowns are present in one or both languages, a study of the bilingual could help to locate the points in the language production process that are affected by schizophrenia. It is possible that, depending on differences in language acquisition contexts and subsequent differential experiences with each language, a bilingual schizophrenic could display deviance in one language and not the other. This line of reasoning may be seen as a logical extension to functional psychosis of the observation that an aphasic insult can have various effects on a bilingual's languages. Lambert and Fillenbaum (1959) contended that the particular post-aphasic pattern probably depends in some complex fashion on "the order in which the languages were learned, the comparative levels of skill attained in each, and the affective value each language has for the individual [p. 455]."

In a discussion of the rate and proportion of a bilingual's alternation between his two languages, Mackey (1962) suggested that control of the foreign language may break down with frequent switching to the mother tongue only when the speaker is in a state of tension due to excitement, anger, or fatigue. Case histories have been cited in clinical studies (Del Castillo, 1970; Schaechter, 1968) in which symptoms were shown in the patients' native languages but to a much lesser degree, if at all, in their second language. Del Castillo (1970) speculated that a foreign-born individual who thinks and dreams in his own language will -- if he becomes psychotic -- distort reality primarily in his own native thoughts and language, possibly because the effort of communicating in another language produces unconscious vigilance over the emotions.

Only recently has any attention been given to experimental investigation of the language processing ability and performance of bilingual schizophrenics. In a pilot study, Gipson, Curry, and Janke (1972) administered oral word association tests to 12 Spanish-English bilingual schizophrenic patients in each of their languages. The patients were grouped according to premorbid adjustment, paranoia, chronicity, age of first use of English, age of first use of Spanish, sex, and age as independent variables. A multiple correlation analysis and F test for significance of regression revealed non-zero relationships between these 7 predictors and 17 dependent variable measures of linguistic performance. Those dependent variables with significant F tests were English multiword responses ($p < .05$), Spanish adjectival responses ($p < .10$), responses shared between the two languages, English-Spanish cross-language responses, Spanish multiword responses, and both English and Spanish verb responses ($p < .25$). These results suggest that a plausible relationship may exist between the selected diagnostic classifications and language behavior variables as measured by a word association test in schizophrenic patients who are bilingual.

On the basis of the results of this pilot study, the psycholinguistic model described above (Jones & Wepman, 1965) was amplified to include the interaction of bilingualism and schizophrenic language behavior. Such an extension builds on models cited in previous research (Clevenger & Matthews, 1971; Macnamara, 1967). Specifically, the theoretical framework for the pilot study was based on a two-switch bilingualism model which controlled the bilingual's dual decoding (input) and encoding (output) systems in an attempt to postulate a functional separation and linguistic independence between the two languages (Macnamara, 1967). However, at this point a revision and simplification of the bilingual model seems adequate to account for much of the verbal behavior observed in the bilingual schizophrenic patients tested.

Clevenger and Matthews (1971) hypothesized an organismic paradigm of communication in which environmental stimuli activate the organism's receptor systems, which in turn transform the neural impulses in the information processing system. This processing system, analagous to the conceptual pattern analyzer in the Jones and Wepman model, feeds its information into physiological response systems and/or effector systems which produce the response and overt behavior. (See Figure 2.)

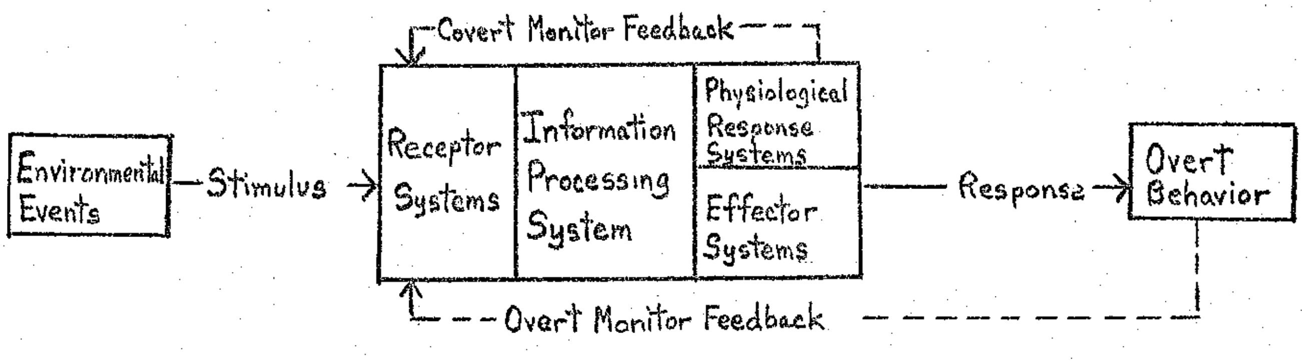

Fig. 2. Model of communication as organismic behavior. (Note.-- Diagram reproduced from Theodore Clevenger and Jack Matthews, The Speech Communication Process, 1971, p. 182.)

According to the authors, as a result of the organism's overt behavior, signals are generated which return to their source and again stimulate the receptors. This self-stimulation, called overt monitor feedback, enables the organism to observe directly and control more effectively its own behavior. Through the operation of covert monitor feedback, the organism also is equipped with internal sensors for detecting changes in its own internal stimuli, which account, for example, for the experiencing of emotional responses.

For purposes of this study, the receptor and information processing systems were extracted from the Clevenger and Matthews (1971) model and modified somewhat in coordination with the Jones and Wepman (1965) model as applied to schizophrenia, resulting in the psycholinguistic model of bilingualism graphically presented in Figure 3. The effects of "breaks" at each level are evaluated later in an attempt to account for the language behavior of bilingual schizophrenics.

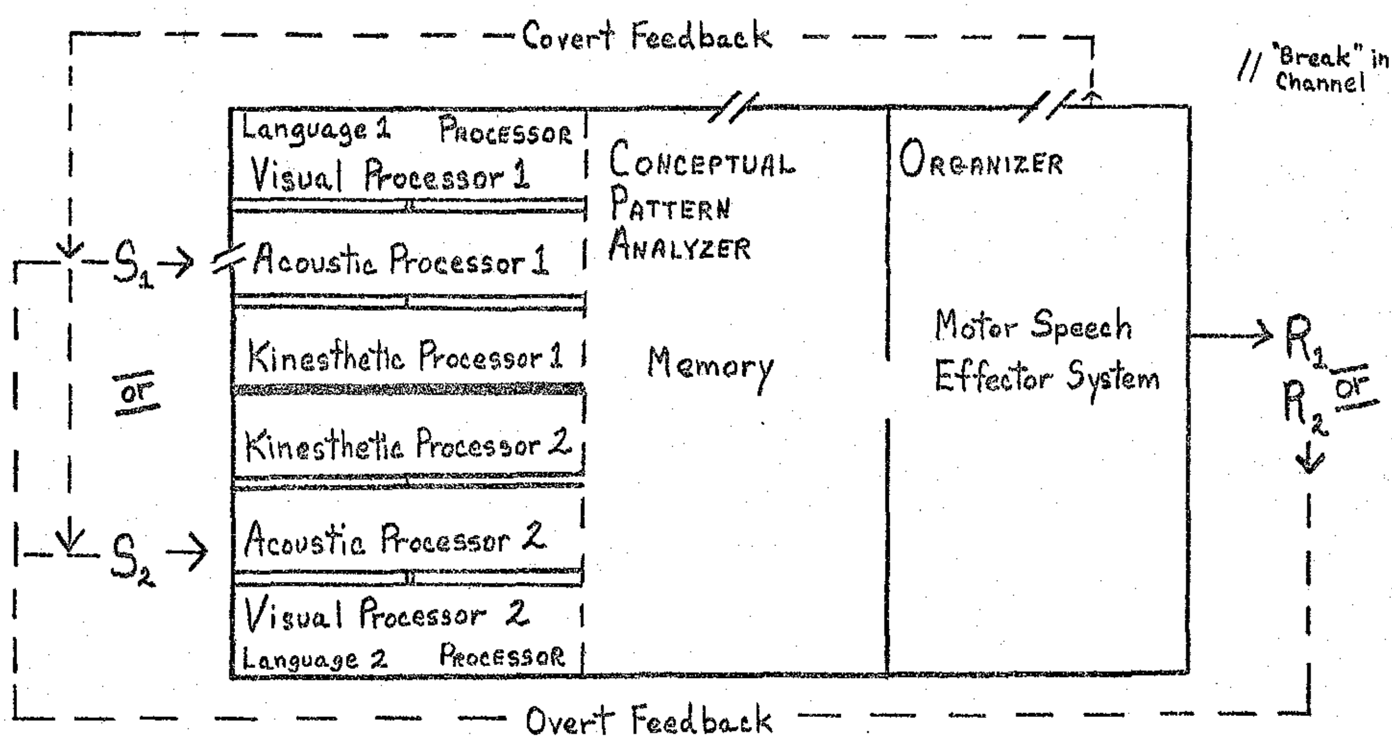

Fig. 3. Major components of a conceptual scheme for bilingual language skills involved in speech.

In this model, only the sensory receptor systems (processors) of the peripheral nervous system are functionally separate for the two languages. The language 1 and language 2 processors are each composed of a kinesthetic, acoustic, and visual detector apparatus. Depending on the language of the environmental stimulus (S), language 1 or 2, the appropriate detection system will be activated automatically. For example, if a stimulus is presented orally in language 1, the language 1 acoustic processor will detect the phonetic characteristics of language 1, and this selected set of signals will be relayed as information to the conceptual pattern analyzer. Similarly, if the stimulus is introduced in the written or printed form of language 1, then the language 1 visual processor would operate to recognize the particular combination of letters as the graphic representation of the stimulus in that language. The language 1 kinesthetic processor would function to differentiate positions and movements of the tongue, mouth, and larynx involved in the articulation and vocalization of a language 1 stimulus. In contrast, if a language 2 stimulus is presented, then processor 2, composed of an effectively separate set of three input channels, would be activated.

Following the detection of the "raw" stimulus, the signal pattern is transmitted to the conceptual pattern analyzer. Here the semantic aspect of language is added to the symbols as they elicit sets of associations built up and stored in the memory as a consequence of past experience with the language. If the response (R) is required in the same language as the stimulus, let us say language 1, then the individual's associational hierarchy for that language will be evoked. However, if the response is required in language 2, then some form of translation or transformation will be necessary. Possibly, rather than the complex switching mechanisms postulated by Macnamara (1967) and Jakobovits (1970), a simpler associational process exists to account for translation. The basic notion of this process is that an individual does not have a single response hierarchy to a given stimulus word (Nunnally, 1965); rather, he has several hierarchies related to his verbal history. Regarding the bilingual specifically, it is hypothesized that his set of associational structures may vary in proportion to his translation experience. For example, if the bilingual customarily responds in language 1 to a language 1 stimulus, then he will have more language 1 high-strength associations to that stimulus. However, his ability to respond in language 2 to a language 1 stimulus will depend on the nature and extent of his prior experience with each language; if he is a skilled translator, then he will have many high-strength cross-language associations which will be elicited more readily than if he habitually speaks in either one language or the other.

This line of thinking seems consistent with Skinner's (1957) discussion of translation as a special case of intraverbal behavior, defined as those language responses which show no isomorphic correspondence with the verbal stimuli which evoke them. According to his theory, successful translation occurs when the speaker also functions as a listener in the new language. This self-stimulating behavior, which may be covert, provides for increasing self-correction as the translator develops more efficient intraverbal operants. When two languages are independently acquired, as with the coordinate bilingual, there may be few intraverbal connections between them. A skillful bilingual may not be a skillful translator unless he has acquired a set of translation intraverbal operants. If he functions simultaneously as a speaker and a listener in both languages, he may try out a translation by comparing the effects of the two versions upon himself and changing the translation until the effects are approximately the same (Skinner, 1957).

To continue with the explanation of the model depicted in Figure 3, whatever associations are evoked in the conceptual pattern analyzer are then relayed to the organizer. At this third level, they are arranged in a pattern corresponding to the syntax of the response language. The effector systems yield this organized response as overt or covert speech behavior. The feedback mechanisms provide for self-correction in a manner similar to that posited by Skinner (1957), as described above.

In the bilingual schizophrenic, possibly functional "breaks" or malfunctions occur at various points in this information processing system. As indicated in Figure 3, these malfunctions may exist in any one or all three of the language processing units; they may be seen as analagous to the hypothetical "breaks" in the transmission channels suggested above and applied to the adaptation of the Jones and Wepman (1965) model for schizophrenic language disorders (see Figure 1). For example, if there is a defect at the peripheral level of the attentional analyzer systems (processors), then stimuli will not be detected and processed properly. The characteristics of a language 1 stimulus would not be recognized as such and, thus, might be processed in terms of language 2. Confusions in stimulus discrimination would provide support for an attentional deficit as a theory of schizophrenic etiology (Cromwell & Dokecki, 1968; Lawson, McGhie, & Chapman, 1964).

A malfunction at the secondary level, the conceptual pattern analyzer, could result in a disorganization of the associational hierarchy or sets of associations hypothesized earlier, as described in the response strength theory of Broen and Storms (1966). Such a breakdown might be demonstrated empirically in increased uncommon, idiosyncratic, or cross-language word associations.

Finally, a malfunction in the organizer could produce perseveration in response style or syntactically disorganized responses. A measure of a defect at this tertiary level could be the multiword responses elicited from the bilingual schizophrenics tested in the pilot study cited above (Gipson, Curry, & Janke, 1972).

It is the purpose of the present study to investigate how premorbidity, chronicity, and paranoia are related to (1) the operation of the dual stimulus processing systems specific to each language, in this case English and Spanish, and (2) the operation of the conceptual pattern analyzer and organizer, each of which functions in a unitary fashion irrespective of language, according to the hypothesized model. Referring to Figure 3 and the results of the pilot study (Gipson, Curry, & Janke, 1972), one might expect that the diagnostic types are differentially related to defects occurring at each of the three levels of information processing as revealed by measures of linguistic performance. If, for example, in comparing paranoids and nonparanoids, more deviant responses result from confusions in stimulus discrimination than from breakdowns in the associational hierarchies, then perhaps that schizophrenic characteristic is related to dysfunctions in the stimulus processor rather than in the conceptual pattern analyzer. Or, premorbidity may be more strongly related to dysfunctions in the conceptual pattern analyzer, as reflected by disruptions in the associational hierarchies, than to organizer dysfunctions. Of course the language production process may be affected by the schizophrenic subclassifications at more than a single point, but in any case the nature of the deviant response could help to establish the locations of these points in the hypothetical model (Figure 3).

Specifically, in a psycholinguistic approach, a word association task in English and in Spanish was used to ascertain differences in language behavior across good- versus poor-premorbid, acute versus chronic, and paranoid versus nonparanoid bilingual schizophrenics.[1] A selection of cross-language homonyms (e.g., flor-floor, rey-ray) and their translations were employed to measure the occurrence of confusions in the stimulus processor unit. These stimuli, each pair having highly similar phonetic representations but quite different denotative meanings, theoretically could be detected acoustically in either language, regardless of the context produced by the language of the stimulus list. For example, if a stimulus presented in Spanish (e.g., flor), is in fact detected by the subject as an English stimulus (e.g., floor), as indicated by his response (e.g., piso), then it could be suggested that the schizophrenic condition is related to functional confusion in the stimulus detection systems. The use of cross-language homonyms, then, provides a device for investigating the relationships between the schizophrenic diagnostic dichotomies and the operation of the peripheral sensory processors, hypothesized to be functionally specific to each language.

To test the theory that the schizophrenic subcategories are related to disruptions in the associational hierarchies established in each language, a second list composed of standard words from the Kent-Rosanoff Word Association Test was used as stimuli. Such measures as uncommon responses, cross-language responses, and responses shared between both languages could be interpreted as evidence of breakdowns in the hierarchies of verbal associations, in one or both languages, and may be more clearly evident in interaction with the psychiatric groupings.

Method

Subjects

A total of 13 Spanish-English bilingual schizophrenics were identified and categorized according to premorbid adjustment, paranoia, and chronicity. There were 10 males and 3 females, ranging in age from 22 to 56 years with a mean age of 38.5 years. Nine of the 13 subjects (_S_s) were originally selected from the Stockton State Hospital patient population to participate in the experimenter's (_E_'s) previous bilingual research (Gipson, Curry, & Janke, 1972); therefore, some of the above diagnostic information had already been obtained from case histories and interviews. However, in the interim, two of the nine were discharged, one female patient to a private convalescent hospital in Stockton and one male to the community to continue on an out-patient basis with the San Joaquin County Mental Health Services.

In order to identify additional subjects necessary to replace unavailable discharged patients, procedures similar to those used with the original group were followed, as described below. Of the additional four subjects located, two were within Stockton State Hospital (one later to be omitted from the results because of failure to perform the task), and two were referred by the San Joaquin County Day Treatment Center, which provides a daily after-care and out-patient mental health program. Both of these _S_s had been hospitalized at some time during the 1-year period previous to the present study.

Part I, items A-F, of the Phillips (1953) scale was used to rate the Ss' prepsychotic behavior and level of adjustment as determined from case history data. (See Appendix 1.) These 6-point prognostic scales cover areas of recent sexual and social maturity, with an average score of 3.5 dividing the good- and poor-premorbid classifications. Scores of 0 through 3 were assigned to more favorable and 4 through 6 to less favorable personality features on a clinical basis. Where sufficient case history material was unavailable, ratings were made on the remaining items in the scale, and the average was computed on the number of items contributing to the total score. Six good-premorbid and seven poor-premorbid Ss resulted.

Patients who had been in the hospital for less than 2 years since the date of their most recent admission were classified as "acute" and those remaining for more than 2 years were considered "chronic." Chronicity for those Ss who were not included in the State Hospital population was determined by the duration of the most recent prior hospital confinement. Seven acute and six chronic Ss were identified.

Paranoid or nonparanoid status was determined by the latest psychiatric code diagnosis for each patient, obtained from the hospital's official medical records. This procedure yielded seven paranoid and six nonparanoid Ss.

The degree and type of bilingualism was ascertained by means of informal patient interviews in both languages prior to the initial testing session. The assessment of "bilingualism" depended on a "yes" answer to one or both of the following questions (Pimsleur, 1961):

1. Is a language other than English spoken regularly in your home?
2. Is your native language other than English?

Questions concerning the age of English- and Spanish-language acquisition were used to identify coordinate and compound bilinguals, as mentioned earlier; the distinction involves the coordinate's learning of the second language after 10 years of age in a setting other than the home. Of the 13 Ss, only one would be considered a coordinate bilingual, since some 20 years separated her first use of Spanish at age 3 and her first use of English at age 26. Otherwise, the Ss would qualify as compound bilinguals as a consequence of learning both languages during childhood in the same cultural context; the mean age for the first use of English was 6.8 years and for the first use of Spanish was 3.8 years. In general, Ss were able to speak and understand both languages with enough facility to converse about such common topics as home life and daily activities.

Ss were randomly assigned to take the English or Spanish version of the word association test first, but each S received both test conditions, with two replications of each.

Materials

The stimuli were 62 single words presented in English, and, in the closest dictionary translation available, also in

Spanish. The words are provided in Appendix 2, listed according to the following four categories: (1) 20 words from the Russell-Jenkins (1954) norm list for the Kent-Rosanoff Word Association Test whose primary associates occurred more than 50% of the time; (2) 2 words of "high frequency" (as measured by the Thorndike-Lorge J-count) from the Russell- Jenkins list and 2 from the Entwisle (1966) list; (3) 4 Russell-Jenkins words of "medium frequency"[2]; (4) 34 words divided into 17 pairs of cross-language homonyms and their translation equivalents. A cross-language homonym is a word in English, in this case, which is pronounced like a word in Spanish but which has a different meaning and spelling (e.g., flor-floor, luz-loose).

A questionnaire regarding language acquisition history (see Appendix 3) was used to report each S's experience with the two languages. A cassette tape recorder was used to record the testing sessions, and a stop watch was used to time the intervals between each stimulus presentation and to motivate the Ss to respond as quickly as possible. Soft drinks and cigarettes were available for the Ss during each session.

Procedure

Once it was determined that a schizophrenic patient was bilingual in Spanish and English, it was explained to him that his cooperation was needed to find out more about how his thoughts were related to his use of two languages. If he agreed to participate, then a testing schedule was arranged for the S, consisting of a total of four sessions, each separated by a span of from two to six days, with an average of 3.6 days. The 62-word stimulus list (see Appendix 2) was administered during each session with a 5-minute rest period scheduled after the first half (31 words), so that two sessions were required to administer the entire list once in each language. Two additional sessions were necessary for a second presentation of each word.

Hospitalized Ss were escorted by E from their wards to the psychology laboratory in the Stockton State Hospital Professional Building. Since the patients were located in various areas throughout the hospital, two basic plans of transfer were used in order to conserve time and energy in transit. In four cases, E accompanied an individual S from his ward to the testing site. In five cases, E, with the help of a research assistant, escorted a group of two to four patients simultaneously to the testing center; while E administered the test to a single S in a sound-proof room, the remaining Ss awaited their turn in the adjoining laboratory area with the research assistant. Both before and during the test administration all conversation between the E and Ss was carried on in the stimulus language, either English or Spanish for any particular trial, in an attempt to establish a language set for that trial. However, for those Ss who waited as a group, the Spanish language set was interrupted, since they tended to use English among themselves and with the research assistant, who was not conversant in Spanish. The language of the stimuli was chosen at random for the first trial and thereafter alternated for the remaining three trials.

Inside the testing room, decorated to suggest a living room atmosphere, each S was seated in a comfortable chair across from E. A tape recorder, stop watch, and stack of cards were in evidence on a round table. So that the S would feel as relaxed as possible in the test situation, he had free access to soft drinks and cigarettes during the waiting period, if any, as well as during the actual testing session. In addition to the planned rest period, breaks were afforded the S on request.

The four Ss who were not State Hospital patients were seen in various locations in the Stockton vicinity. E visited the Crestwood Convalescent Hospital four times to work with the one S hospitalized there. A comfortable office-conference room was used for the interview and test administrations. Another S, who continued as an out-patient after his initial participation in the pilot study (Gipson, Curry, & Janke, 1972), agreed to appear for a series of four appointments at the testing room on the State Hospital grounds.

One of the Ss referred by the Day Treatment Center was tested in her own home, a small apartment in downtown Stockton. E brought the necessary equipment and materials, including refreshments, and the living room provided an adequate, although not ideal, setting for testing purposes. (This S was one of two later to be excluded from the analysis of results due to the perseveration of her Spanish-to-English translation responses.)

E met with the other S at the Day Treatment Center for three of the four testing sessions, using offices and conference rooms as available. For the second test trial, however, the S was unable to come to the center, so E went to the S's home, a farm in rural Stockton. Although there were several animals and family members present in the house, a semi-private testing arrangement was devised in the kitchen so that the S relaxed sufficiently to participate effectively.

In all cases the discrete association method was employed in which a single word was requested as a response to each stimulus, although a multiple-word response was accepted. An auditory mode of presentation with individual Ss was used, where E orally presented each stimulus to the S, and each of the S's oral responses was recorded on a tape recorder and later transcribed onto an answer sheet by E. The E had in front of him a stack of 62 3" x 5" cards, on each of which one of the stimulus words was written. These words were not visible to the S, but only to the E. To minimize specific order and context effects, different random orders of presentation were used between and within Ss. The stimuli were arranged in blocks of five, and the blocks were presented in different random orders according to a predetermined set of lists.

After some preliminary amenities, E completed the

Language Acquisition History Questionnaire (see Appendix 3) for the S on the basis of an oral interview in the stimulus language. Subsequently, E gave word association test instructions (see Appendix 4), also in the language of the stimuli. Although it was anticipated that the established language set would increase the probability that the responses would be given in the same language as the stimuli, neither the language of the stimuli nor the language in which the S was expected to respond was specified. Since the structure of the S's associative hierarchies was of interest, hopefully his choice of response language reduced the deletion of cross-language responses which might have been in these hierarchies.

The S's task was to respond to the stimulus word with the first single word that came to mind other than the stimulus word itself. The E stressed the fact that the S's response latency would be noted, as a method of encouraging rapid, spontaneous responses. In the oral-aural procedure, there was a maximum 15-second interval for each stimulus word. If, within that time period, the S did not respond, then that card was set aside and E continued with the remaining cards. At the end of the test, E returned to the omitted cards, and S had another opportunity to respond to those stimulus words. If at that point he still failed to respond, then the particular word was omitted from the S's protocol for that trial.

When the word association task was completed, E commended S, explaining that he did well and thanking him for his cooperation. The E answered as simply as possible any questions that the S had and then reminded the S of his next appointment. When necessary for security reasons, E then escorted the S from the test center back to his ward.

Results

The 19 dependent variables were derived from the word association test responses for each <u>S</u> in each language, based on frequency counts of responses shared between the two languages, cross-language responses, multiword responses, parts of speech (nouns, adjectives, verbs), commonality, confusion responses, and translation responses. (See Table 1 for a complete list of the variables, each to be described subsequently in this section.)

To discover significant relationships between the psychiatric and demographic classifications (independent or predictor variables) and the language behavior variables, the Burroughs Assist computer program package was used to analyze the data. This program yielded a product moment multiple correlation (multiple $\underline{R}$), a "corrected" $\underline{R}$ based on expected shrinkage due to sample size, an $\underline{F}$ test for significance of regression, a partial correlation ($\underline{r}$) between any one dependent variable and each of the independent variables, and a Pearson product moment correlation coefficient matrix for all possible pairs of variables ($\underline{r}_{xy}$).

Two of the 13 subjects tested characteristically responded by translating a Spanish stimulus word to its English counterpart, despite suggestions by <u>E</u> that this type of response set was inappropriate. Since such a response set effectively suppressed all other possible variations in association behavior, these <u>S</u>s were disregarded. As might be expected, 14 of the

19 multiple correlation coefficients (*R*) increased after extracting the data of the two *S*s who perseverated with the Spanish-to-English translation responses from the analysis. (See Table 1.) However, this revised correlation analysis, based on 11 rather than the original 13 observations, did not produce a concomitant number of significant *F* tests for significance of regression due to the decreased number of subjects. With a smaller *N*, the critical *F* values were increased, so there was less probability that a significant *F* test would result. Yet with almost 74% of the *R*s increasing when the two subjects were omitted, it seemed logical that they had had a suppressing effect on the previously obtained correlations, and a greater *N* of conventionally responding subjects would have yielded more significant *F* tests. Consequently, the following data analysis refers to the results collected from the 11 *S*s who appropriately performed the task, with the two Spanish-to-English perseverating *S*s discarded.

For shared responses, the dependent variable which measured the frequency of equivalent responses occurring in both Spanish and English, the multiple *R* was .66. The multiple *R* for the Spanish-English cross-language variable was .82. This variable was a measure of the number of English responses evoked by Spanish stimuli.

The multiple *R* and corrected *R* for the English multiword variable were .89 and .55, respectively. A partial correlation of −.62 between the Phillips score and English multiword response

Table 1

Multiple $\underline{R}$s Including ($\underline{N}$ = 13) and Excluding ($\underline{N}$ = 11) Perseverating Spanish-to-English Translators

Dependent Variable	$\underline{N}$=13	$\underline{N}$=11
Shared responses	.65	.66
Spanish-English cross-language	.77	.82
English multiword	.61	.89
Spanish multiword	.53	.83
Spanish nouns	.82	.86
English adjectives	.70	.85
Spanish adjectives	.73	.70
English verbs	.65	.65
Spanish verbs	.48	.52
English primary-English norms	.76	.83
Spanish primary-Spanish norms	.76	.75
Spanish primary non-shared	.64	.70
English-unique-shared	.41	.88
Spanish-unique-shared	.62	.81
English-Spanish confusions	.59	.92
Spanish-English confusions	.74	.69
English-Spanish translations	.87	.99
Spanish-English translations	.76	.85
Spanish-English cross-language-without-translations	.88	.87

Table 2a

Means for Shared Responses

	Good-premorbid		Poor-premorbid	
	Paranoid	Nonparanoid	Paranoid	Nonparanoid
Acute	50.00 n=1	50.00 n=1	50.00 n=1	61.00 n=2
Chronic	33.50 n=2	n=0	55.00 n=2	33.00 n=2

Note.— N = 11 was sample size after Spanish-English translators were extracted from the results. Values of n are the same for Tables 2-20.

Table 2b

Schizophrenic Condition	Marginal Mean
Acute	54.40
Chronic	40.50
Good-premorbid	41.75
Poor-premorbid	49.71
Paranoid	46.17
Nonparanoid	47.60

Table 3a

Means for Spanish-English Cross-Language Responses

	Good-premorbid		Poor-premorbid	
	Paranoid	Nonparanoid	Paranoid	Nonparanoid
Acute	21.00	8.00	35.00	11.00
Chronic	3.50		8.50	3.00

Table 3b

Schizophrenic Condition	Marginal Mean
Acute	17.20
Chronic	5.00
Good-premorbid	9.00
Poor-premorbid	11.43
Paranoid	13.33
Nonparanoid	7.20

Table 4a

Means for English Multiword Responses

	Good-premorbid		Poor-premorbid	
	Paranoid	Nonparanoid	Paranoid	Nonparanoid
Acute	2.00	90.00	13.00	7.00
Chronic	2.00		2.50	15.00

Table 4b

Schizophrenic Condition	Marginal Mean
Acute	23.80
Chronic	6.50
Good-premorbid	24.00
Poor-premorbid	8.86
Paranoid	4.00
Nonparanoid	26.80

Table 5a

Means for Spanish Multiword Responses

	Good-premorbid		Poor-Premorbid	
	Paranoid	Nonparanoid	Paranoid	Nonparanoid
Acute	4.00	37.00	10.00	6.50
Chronic	9.50		2.00	20.00

Table 5b

Schizophrenic Condition	Marginal Mean
Acute	12.80
Chronic	10.50
Good-premorbid	15.00
Poor-premorbid	9.57
Paranoid	6.17
Nonparanoid	18.00

Table 6a

Means for Spanish Nouns

	Good-premorbid		Poor-premorbid	
	Paranoid	Nonparanoid	Paranoid	Nonparanoid
Acute	54.00	31.00	38.00	29.50
Chronic	61.50		76.00	74.50

Table 6b

Schizophrenic Condition	Marginal Mean
Acute	36.40
Chronic	59.00
Good-premorbid	52.00
Poor-premorbid	56.86
Paranoid	61.17
Nonparanoid	47.80

Table 7a

Means for English Adjectives

	Good-premorbid		Poor-premorbid	
	Paranoid	Nonparanoid	Paranoid	Nonparanoid
Acute	28.00	1.00	6.00	33.00
Chronic	28.00		25.50	12.00

Table 7b

Schizophrenic Condition	Marginal Mean
Acute	20.20
Chronic	21.83
Good-premorbid	21.25
Poor-premorbid	21.00
Paranoid	23.50
Nonparanoid	18.20

Table 8a

Means for Spanish Adjectives

	Good-premorbid		Poor-premorbid	
	Paranoid	Nonparanoid	Paranoid	Nonparanoid
Acute	21.00	0.00	19.00	30.00
Chronic	30.50		23.50	17.50

Table 8b

Schizophrenic Condition	Marginal Mean
Acute	20.00
Chronic	23.83
Good-premorbid	20.50
Poor-premorbid	23.00
Paranoid	24.67
Nonparanoid	19.00

Table 9a

Means for English Verbs

	Good-premorbid		Poor-premorbid	
	Paranoid	Nonparanoid	Paranoid	Nonparanoid
Acute	8.00	6.00	7.00	25.50
Chronic	5.00		7.00	4.50

Table 9b

Schizophrenic Condition	Marginal Mean
Acute	14.40
Chronic	5.50
Good-premorbid	6.00
Poor-premorbid	11.57
Paranoid	6.50
Nonparanoid	13.20

Table 10a

Means for Spanish Verbs

	Good-premorbid		Poor-premorbid	
	Paranoid	Nonparanoid	Paranoid	Nonparanoid
Acute	13.00	5.00	15.00	36.50
Chronic	9.50		3.50	7.00

Table 10b

Schizophrenic Condition	Marginal Mean
Acute	21.20
Chronic	6.67
Good-premorbid	9.25
Poor-premorbid	15.57
Paranoid	9.00
Nonparanoid	18.40

Table 12a

Means for Spanish Primary-Spanish Norms

	Good-premorbid		Poor-premorbid	
	Paranoid	Nonparanoid	Paranoid	Nonparanoid
Acute	15.00	2.00	11.00	22.50
Chronic	18.50		17.50	12.50

Table 12b

Schizophrenic Condition	Marginal Mean
Acute	14.60
Chronic	16.17
Good-premorbid	13.50
Poor-premorbid	16.57
Paranoid	16.33
Nonparanoid	14.40

Table 13a

Means for Spanish Primary Non-Shared Responses

	Good-premorbid		Poor-premorbid	
	Paranoid	Nonparanoid	Paranoid	Nonparanoid
Acute	5.00	0.00	6.00	7.50
Chronic	5.50		4.50	4.00

Table 13b

Schizophrenic Condition	Marginal Mean
Acute	5.20
Chronic	4.67
Good-premorbid	4.00
Poor-premorbid	5.43
Paranoid	5.17
Nonparanoid	4.60

Table 14a

Means for English-Unique-Shared

	Good-premorbid		Poor-premorbid	
	Paranoid	Nonparanoid	Paranoid	Nonparanoid
Acute	4.00	18.00	20.00	3.50
Chronic	5.00		5.50	5.00

Table 14b

Schizophrenic Condition	Marginal Mean
Acute	9.80
Chronic	5.17
Good-premorbid	8.00
Poor-premorbid	6.86
Paranoid	7.50
Nonparanoid	7.00

Table 15a

Means for Spanish-Unique Shared

	Good-premorbid		Poor-premorbid	
	Paranoid	Nonparanoid	Paranoid	Nonparanoid
Acute	10.00	17.00	14.00	7.50
Chronic	4.50		7.00	5.00

Table 15b

Schizophrenic Condition	Marginal Mean
Acute	11.20
Chronic	5.50
Good-premorbid	9.00
Poor-premorbid	7.57
Paranoid	7.83
Nonparanoid	8.40

Table 16a

Means for English-Spanish Confusions

	Good-premorbid		Poor-premorbid	
	Paranoid	Nonparanoid	Paranoid	Nonparanoid
Acute	2.00	5.00	1.00	1.50
Chronic	1.00		0.00	0.50

Table 16b

Schizophrenic Condition	Marginal Mean
Acute	2.20
Chronic	0.50
Good-premorbid	2.25
Poor-premorbid	0.71
Paranoid	0.83
Nonparanoid	1.20

Table 17a

Means for Spanish-English Confusions

	Good-premorbid		Poor-premorbid	
	Paranoid	Nonparanoid	Paranoid	Nonparanoid
Acute	3.00	5.00	11.00	4.50
Chronic	3.00		7.00	4.50

Table 17b

Schizophrenic Condition	Marginal Mean
Acute	5.60
Chronic	4.83
Good-premorbid	3.50
Poor-premorbid	6.14
Paranoid	5.67
Nonparanoid	4.60

Table 18a

Means for English-Spanish Translations

	Good-premorbid		Poor-premorbid	
	Paranoid	Nonparanoid	Paranoid	Nonparanoid
Acute	1.00	1.00	36.00	0.00
Chronic	0.00		0.00	0.00

Table 18b

Schizophrenic Condition	Marginal Mean
Acute	7.60
Chronic	0.00
Good-premorbid	0.50
Poor-premorbid	5.14
Paranoid	6.17
Nonparanoid	0.20

Table 19a

Means for Spanish-English Translations

	Good-premorbid		Poor-premorbid	
	Paranoid	Nonparanoid	Paranoid	Nonparanoid
Acute	5.00	2.00	23.00	7.50
Chronic	1.00		4.50	1.00

Table 19b

Schizophrenic Condition	Marginal Mean
Acute	16.20
Chronic	2.17
Good-premorbid	2.25
Poor-premorbid	7.00
Paranoid	6.50
Nonparanoid	3.80

Table 20a

Means for Spanish-English Cross-Language-Without-Translations

	Good-premorbid		Poor-premorbid	
	Paranoid	Nonparanoid	Paranoid	Nonparanoid
Acute	16.00	6.00	12.00	3.50
Chronic	2.50		4.00	2.00

Table 20b

Schizophrenic Condition	Marginal Mean
Acute	8.20
Chronic	2.83
Good-premorbid	6.75
Poor-premorbid	4.43
Paranoid	6.83
Nonparanoid	3.40

variable suggested that poor-premorbidity was related to fewer multiword responses. The partial correlation of paranoia with the dependent variable was .57, indicating that paranoia was related to fewer multiword responses in English. The first-use-of-Spanish partial was .57, demonstrating that the older a subject was when he first learned Spanish, the more he tended to respond with non-discrete English associations. The partial correlation of .54 with the sex variable showed that females gave more English multiword responses than males.

The Spanish multiword multiple R was .83. Premorbidity and paranoia contributed most to this correlation, with -.43 and .57 partial correlations, respectively. Both the poor-premorbid and paranoid patients tended to give fewer Spanish multiword responses, relationships similar to those observed with the English multiword variable discussed above.

The Spanish nouns variable yielded a multiple R of .86 and R corrected of .34. The schizophrenic conditions of poor-premorbidity and paranoia were related to a higher frequency of Spanish noun responses, as evidenced by partial correlations of .38 and -.48, respectively.

The multiple R for English adjectives was .85 and the corrected R was .26. First-use-of-Spanish and sex were the principal contributors to the multiple R, with partial correlations of -.45 and -.40, respectively. The older a S was when he learned Spanish, the fewer English adjectival responses he gave, and females gave fewer than males.

The multiple R for Spanish adjectives was .70. The multiple R for English verbs was .65. Acuteness contributed most to the multiple R, with a -.27 partial correlation suggesting that subjects identified as "acute" rather than "chronic" tended to give more English verb responses. The multiple R for Spanish verbs was .52.

For the English primary-English norm variable, a measure of response commonality based on the Russell-Jenkins norms, the multiple R was .83. First-use-of-Spanish and sex yielded the highest partial correlations (-.40 and -.30, respectively), suggesting that the later a bilingual subject learned Spanish, the fewer primary English responses he gave, and females gave fewer than males.

The multiple R for Spanish primary-Spanish norms yielded a coefficient of .75. The first-use-of-Spanish independent variable, with a partial correlation of -.32, contributed most to the multiple R; the younger the bilingual subject was when he first used Spanish, the more primary responses he gave, according to the bilingual norms.[3]

For Spanish primary non-shared responses the multiple R was .70. This dependent variable identified a measure of commonality with the omission of responses appearing in both Spanish and English protocols. Partial correlations were .39 for the Phillips score, -.37 for acuteness, .29 for the first-use-of-English, and -.33 for first-use-of-Spanish. This result demonstrated that the earlier poor-premorbid and acute

Ss learned Spanish, the more they emitted primary responses not shared in both languages, based on the bilingual norms.

The value of the multiple R for the English-unique-shared variable was .88, with a corrected R of .50. The highest partial correlations occurred for the Phillips score (-.54), first-use-of English (-.62), and sex (.66), suggesting that the earlier that good-premorbid, female subjects learned English the greater was their tendency to give the same unique responses in both languages, counted on the basis of the English norms.

The Spanish-unique-shared multiple R was .81. This variable defined a frequency count of the unique responses shared in both languages according to the bilingual norms previously mentioned. The principal contributors to this multiple R were the Phillips score (-.46), first-use-of-English (-.44), and sex (.42), as reflected in their respective partial correlations. It appeared that, on the basis of bilingual norms, the earlier good-premorbid female Ss learned English, the more they gave unique responses occurring in both languages.

The English-Spanish confusions variable was strongly related to the seven predictor variables, a relationship demonstrated by the multiple R = .92 and corrected R = .71. Partial correlations of -.62 with the Phillips score and .55 with paranoia indicated both poor-premorbidity and paranoia were related to fewer confusions in stimulus discrimination.

The multiple $\underline{R}$ for Spanish-English confusions was .69. The partial correlation of -.32 for first-use-of-English was the greatest contributor to the multiple $\underline{R}$; the younger a subject was when he first learned English, the more he tended to respond with associations of the Spanish-English confusion type.

For the English-Spanish translation variable, a significant $\underline{F}$ test ($p < .01$) and $\underline{R}$ corrected = .99 indicated a highly significant relationship between the predictor variables and linguistic variable, with first-use-of-English and sex contributing the highest partial correlations, -.92 and .95, respectively. These statistics suggested that the older a bilingual schizophrenic was when he first learned English, the less he responded with Spanish translation equivalents when presented with English stimuli, and female $\underline{S}$s responded with more Spanish translation equivalents than males.

The multiple $\underline{R}$ for the Spanish-English translation response variable was .85 and the corrected $\underline{R}$ was .31. Sex, with a partial correlation of .28, was the principal contributor to the multiple $\underline{R}$, which suggested, as with the previous translation variable, that females tended to respond with more English translations when presented with Spanish stimulus words.

The Spanish-English cross-language-without-translation variable yielded a multiple $\underline{R}$ of .86 and a corrected $\underline{R}$ of .42. For this analysis, the highest partial correlations resulted for paranoia (-.37) and age (-.31), indicating that younger, paranoid subjects gave more such responses.

The Assist program package also yielded a matrix of correlation coefficients ($\underline{r}_{xy}$) between each pair of the 26 variables involved in the study for the 11 $\underline{S}$s included in the revised analysis. The following discussion describes the relationships obtaining between each independent (predictor) variable and each dependent variable where $\underline{r}_{xy} \geq \pm .30$.

The Phillips score was positively correlated with Spanish nouns (.32) and Spanish primary non-shared responses (.31) and inversely correlated with English-Spanish confusions (-.62) and the Spanish-English cross-language-without-translations variable (-.38). Since a high Phillips score identified a poor-premorbid subject, the resulting coefficients indicated that a poor-premorbid bilingual schizophrenic tended to respond with more Spanish nouns, with more Spanish primary non-shared words, with fewer English-Spanish confusions, and with fewer English words to Spanish stimuli when translation equivalents were omitted from the count. The $\underline{r}_{xy} = .31$ between Phillips and first-use-of-Spanish, both independent variables, suggested that poor-premorbid subjects learned Spanish at a later age than did subjects who were relatively well-adjusted prior to the onset of the schizophrenic condition.

Paranoia correlated directly with English multiword responses (.46), Spanish multiword responses (.51), English verbs (.40), Spanish verbs (.35), and English-Spanish confusions (.34); it correlated inversely with Spanish-English cross-language-without-translations (-.36). As an independent variable, paranoia was designated by a binomial score, 1 for paranoid and 2 for nonparanoid, based on the psychiatric code diagnosis for each S. An interpretation of the coefficients, then, implied that paranoid bilingual schizophrenic subjects answered with fewer English and Spanish multiword associations, with fewer English and Spanish verbs, and with fewer responses reflecting incorrect detection of the English stimuli. Furthermore, paranoid subjects gave more English responses to Spanish stimuli with translation equivalents disregarded. Coefficients of -.31 and .43 for first-use-of-English and first-use-of-Spanish, respectively, with paranoia, signified that the paranoid patients had learned English later than they had learned Spanish.

Acuteness, measured by the duration in months of the most recent hospital confinement, was positively correlated with Spanish nouns (.35) and Spanish adjectives (.38); negative correlations resulted for English verbs (-.39), Spanish verbs (-.32), Spanish-English cross-language responses (-.43), Spanish-unique-shared responses (-.40), English-Spanish confusions (-.35), Spanish-English translations (-.33), and Spanish-English cross-language-without-translations (-.46). A subject classified as acute (less than 2 years in the hospital) as opposed to chronic, tended to give fewer Spanish nouns and adjectives, but more English and Spanish verbs, more English responses to Spanish stimuli, more unique bilingual norm responses shared by both language protocols, more responses manifesting confusions in the detection of English stimuli, more English translations of Spanish stimuli, and more Spanish-to-English responses with translations excluded. In addition, $\underline{r}_{xy} = .64$ between acuteness and first-use-of-English attested to the tendency for acute subjects to have learned English at an early age.

The first-use-of-English correlated inversely with shared responses (-.49), English primary responses (-.42), and Spanish-unique-shared responses (-.33). The interpretation of these statistics led to the generalization that the earlier a bilingual schizophrenic subject learned English, the greater was the tendency for him to respond to translation equivalent stimuli with the same associations in both languages, to respond with the most frequent response appearing in the Russell-Jenkins norms, and to respond with more uncommon bilingual norm associations in both languages.

The first-use-of-Spanish independent variable correlated positively with English multiword responses (.41) and Spanish nouns (.41), and negatively with shared responses (-.31), Spanish-English cross-language responses (-.33), English adjectives (-.38), Spanish adjectives (-.48), English primary responses (-.37), Spanish (bilingual) primary responses (-.36), and Spanish-English translations (-.41). The earlier a subject learned Spanish, the less he tended to reply with non-discrete English associations and with Spanish nouns. In contrast, there was an increased tendency for him to give associations shared between the two languages, English associations to Spanish stimuli, English and Spanish adjectives, English and Spanish primary responses, and English translations of Spanish stimuli. In general, regarding the last two independent variables which have been discussed, it should be evident that both an early acquisition of English and an early acquisition of Spanish were related to the occurrence of more shared responses between the two languages and more English primary responses.

Sex, designated as 1 for male and 2 for female, was directly correlated with Spanish-English cross-language responses (.42), English-unique-shared (.37), English-Spanish translations (.67), and Spanish-English translations (.44). Sex was inversely correlated with shared responses (-.33), English adjectives (-.41), English primary responses (-.45), and Spanish primary responses (-.32). Bilingual schizophrenic male subjects gave fewer English responses to Spanish stimuli, fewer uncommon English-norm responses in both languages, fewer Spanish translation responses to English stimuli, and fewer English responses to Spanish stimuli. Conversely, male subjects gave more shared responses, more English adjectives, and more English and Spanish primary responses than did female subjects.

Age correlated directly with English adjectives (.46), English primary responses (.40), and Spanish primary responses

(.41); age correlated indirectly with Spanish-English cross-language responses (-.46), English-unique-shared responses (-.31), Spanish-unique-shared responses (-.33), English-Spanish translations (-.47), Spanish-English translations (-.30), and Spanish-English cross-language-without-translation responses (-.58). Generally, with increasing age, subjects tended to give more English adjectives and more English and Spanish primary responses; fewer English responses to Spanish stimuli; fewer uncommon responses shared in both languages (based on the Russell-Jenkins and bilingual norms); fewer English-Spanish and Spanish-English translation equivalent responses; and fewer English responses to Spanish stimuli with translations discounted.

Discussion

The absolute magnitude of the multiple R and partial r coefficients indicates the strength of the relationship, that is, the extent to which a measure of linguistic performance -- shared responses, multiword responses, cross-language responses, parts of speech, response commonality, confusion responses, and translation responses -- can be predicted from the data involving psychiatric status, language acquisition history, age, and sex. The sign of the numerical value signifies the direction of the relationship, either direct or inverse, and thus provides a hint about the underlying mechanism that produced the relation between the variables. It should be emphasized, however, that a high correlation (a value close to +1 or -1) does not indicate a causal relationship *per se*.

With all 19 multiple correlation coefficients (R) resulting in values greater than .50, there appears to be evidence for the existence of at least moderately strong relationships between the seven predictor variables and the 19 measures of linguistic behavior. On the basis of empirical support, then, certain statements can be made about the interrelatedness of the predictor variables with the language behavior (dependent) variables observed.

The $R = .66$ for responses shared in both languages might be expected on the basis of the preponderance of compound bilinguals in the study. Since all but one subject learned both Spanish and English during childhood in the same cultural context, they probably would possess two sets of equivalent signs for the same class of referents, thereby assigning equivalent meanings to corresponding words and expressions in the two languages (Ervin & Osgood, 1954). With regard to the hypothesized psycholinguistic model of bilingualism (Figure 3), this result would support the existence of a conceptual pattern analyzer which is functionally common for the two languages; the associational hierarchies for each language share some equivalent elements as a consequence of similar experiences in both Spanish and English.

Spanish-English cross-language responses with $\underline{R} = .82$ indicated that the number of English words evoked by Spanish stimuli is strongly related to the predictor variables, which account for 68% of the variance in this measure. According to the $\underline{r}_{xy}$ matrix, the younger and more acute the Ss and the earlier the Ss learned Spanish, the more cross-language responses they gave. Possibly the acute condition affected the organization of the associational hierarchies established in the conceptual pattern analyzer (Figure 3) as Broen and Storms (1966) would expect, increasing the strength of cross-language responses relative to already high-strength same-language responses.

When Spanish-English translations (e.g., cama-bed) were excluded from the frequency count of cross-language responses, the value of $\underline{R}$ for the resulting measure increased; that is, the Spanish-English cross-language-without-translations variable had a stronger predictive relationship with the independent variables (_R_ = .87), with 75% of the variance accounted for. The partial _r_'s for paranoia and age contributing to this relationship suggest that paranoia also influenced the structure of the associational hierarchies, so that paranoid _S_s emitted more associations in English to Spanish stimuli, not including direct translation equivalents. It would seem, then, that both acuteness and paranoia were affecting that aspect of language behavior which resulted in bilingual _S_s responding to a stimulus in one language with an association in their second language. With reference to the model (Figure 3), this outcome could point to a malfunction at the level of the conceptual pattern analyzer, and, therefore, to a disruption of the established sets of associations.

The English multiword (_R_ = .89) and Spanish multiword (_R_ = .83) variables were strongly related to the seven independent variables, with 79% and 69%, respectively, of the variance in these verbal behavior variables attributable to variation in the predictors. Premorbidity and paranoia were among the principal contributors to both _R_s, such that poor-premorbidity and paranoia were related to fewer Spanish and English multiword responses. This outcome would discourage an interpretation that malfunctions in the tertiary level response organizer (Figure 3) were related to the designated schizophrenic subcategories. Since the word association instructions specifically described the task as responding with the first single word that came to mind, the lack of multiword responses given by Ss in these schizophrenic categories suggests that the organizer was not influenced by effects of the conditions. Or, if non-discrete responses were organized at the level of covert behavior, they were effectively edited by the feedback mechanism and reformulated before they became overt speech patterns.

In addition, the older a subject was when he first learned Spanish, the more he tended to respond with multiword English associations. Such a phenomenon seems logical in light of the sequence of his language acquisition; since Ss had had more experience with the language acquired earliest, they had built up more extensive associations in that language, English, in this case. The quantity of these associations also would increase their response strength in the associational hierarchies in the secondary level conceptual pattern analyzer (Figure 3) as a consequence of the Ss' prior language experience.

The Spanish nouns (R = .86) variable was a count of how many noun associations were elicited in Spanish by Spanish stimuli. Again, there was a strong relationship obtaining between this language behavior variable and the predictor variables, with 73% of the variance accounted for by variation in the seven psychiatric and demographic categories. There was a much greater frequency of nouns appearing in the norm lists, an indication that this specific part of speech would be the most firmly established in the associational hierarchies of the conceptual pattern analyzer (Figure 3); quick onset (good-premorbid condition) and nonparanoid form of schizophrenia evidently increased the strength of associations in the hierarchy most, increasing the relative number of lower strength (non-noun) responses.

Both English (R = .85) and Spanish (R = .70) adjective responses were related to the independent variables, although more of the variance in the English variable was accounted for than in the Spanish variable, 72% and 48%, respectively. The inverse partial correlation between English adjectives and first-use-of-Spanish suggests that the younger a subject was when he learned Spanish, the more English adjectival responses he gave. Possibly, even though he had had more experience with Spanish as a consequence of learning primacy, the subject was giving more syntagmatic (relation of word to word, such as "man-strong") than paradigmatic (same word class, such as "man-woman") responses in English because of high-strength adjectival associations; these adjectives might be more readily available as a result of having to describe abstract qualities of the environment as the dominant language, English, developed later in life. Since most Ss had been using English more than Spanish on a daily basis, there was more need for them to develop the vocabulary necessary to make descriptive statements (using adjectives to modify nouns) than in the lesser-used language, Spanish.

Since only 16 of the stimulus words were adjectives, there is some evidence to demonstrate that syntactical associations were a function of the effect of the independent variables on the language processing system of the bilingual subjects. Although not one of the principal contributors to the relationship, paranoia had a partial correlation of -.30 with the English adjective variable, indicating at least a slight tendency for paranoid Ss to respond with more such associations. An alternative to the above explanation involving language experience might be that this schizophrenic condition had some effect on the associational hierarchy which increased the incidence of the adjectival responses; such syntactic or sequence associations, which complete or enlarge upon the stimulus word, are commonly seen in children as opposed to the parallel (paradigmatic) associations given by adults (Miller, 1951). Possibly paranoia was effecting the perseveration of a childhood response set.

The Spanish adjective variable was less strongly related to the predictors than that of English adjectives, and even decreased slightly when the two Spanish-to-English translators were discounted from the results. These two Ss, then, obviously contributed some quality to the relationship, which, although not clear at this point, might pertain to the greater lack of translation equivalence between adjectives since they represent abstract rather than concrete referents. One suggestion to explain the lower proportion of the variance accounted for in this variable in comparison with English adjectives is the possibility that the independent variables had less influence on the associational hierarchies of the language used later in life and with which the Ss had had more recent and consistent practice.

In this study the English verbs and Spanish verbs variables were the measures of linguistic behavior least strongly related to the independent variables. Only 42% and 27% of the variance in these two variables, respectively, were accounted for by variation in the seven predictors. This result might be a consequence of the predominance of nouns and adjectives in the associational hierarchies, as demonstrated by the most frequently occurring responses in the Russell-Jenkins norms. Also, since only two of the stimulus words were verbs, there were less opportunities for the Ss to respond with paradigmatic associations. Acute Ss gave more English verb responses, a possible reflection of the acute condition's effect on the conceptual pattern analyzer (Figure 3). Again, as Broen and Storms (1966) would expect, the short length of onset of the schizophrenic syndrome was related to the disruption of the associational structures, so that usually high-strength associations were deleted in favor of the weaker verb associations. Verbs, as "action" words, would seem to emphasize the "functions" of the noun words used as stimuli as important in determining the altered response strengths.

The $\underline{R}$ = .52 for Spanish verbs indicated that this linguistic behavior measure was only moderately related to the independent variables. Without any outstanding partial correlations, there was no distinct principal contributor to the relationship. Again, the primarily noun and adjective stimuli would not be anticipated to elicit verb responses, especially in a language which was not commonly used in daily communication.

With regard to measures of response commonality, the English primary-English norms variable ($\underline{R}$ = .83) was strongly related to the seven independent variables. To explain, the frequency with which the bilingual schizophrenic $\underline{S}$s responded with the primary response word given in the Russell-Jenkins norms was directly related to the schizophrenic and demographic classifications, clearly indicating disorganization of word association hierarchies by the schizophrenic conditions. Seventy per cent of the variance in this language variable was attributable to variation in the predictors. The outcome that the later first-use-of-Spanish was related to fewer primary English responses could be explained by the interference of more recently acquired associations in the hierarchies of the conceptual pattern analyzer, producing competing responses in the second language.

The Spanish primary-Spanish norms variable ($\underline{R}$ = .75) was less strongly related to the predictor variables than the corresponding English measure of commonality described above, with 56% of the variance accounted for. The effect of the

Spanish-to-English translators on the R for this variable was negligible even though their increased number of English responses to Spanish stimuli would have increased the number of unique responses based on the bilingual norms. In terms of the partial correlations, the younger the bilingual S was when he first used Spanish, the more primary bilingual responses he emitted, indicating that the psychiatric categories had relatively little effect on the well-established language habits which had developed from an early age, when nouns were first used. It appears, then, that the psychiatric categories did not have a well-defined effect on the measures of response commonality in either language; it was the interrelatedness of the seven independent variables with each of the commonality variables which produced the strength of the relationships represented by the R in each case.

For Spanish primary non-shared responses ($R = .70$), there was a relationship obtaining between the independent variables and this measure of commonality, a measure in which the translation equivalent responses to the same stimuli in each language protocol were omitted from the frequency count of primary bilingual responses. The principal partial r's suggest that poor-premorbid and acute Ss who learned Spanish at an early age and English later tended to emit primary responses which appeared only in the Spanish protocols. The poor-premorbid and acute conditions seemed to affect the commonality measure when translation equivalents were excluded for Ss who began to use Spanish early, even though the overall R was less than for the Spanish primary-Spanish norms variable. Such a result would support the notion that an individual has several response hierarchies to a given word based on his translation experience. Even with experience in two languages, the bilingual cannot translate directly every word especially if there was some difference between the ages at which each language was acquired. Therefore, certain high-strength associations remained specific to each language. Premorbidity and acuteness seemed to increase the occurrence of primary responses specific to Spanish, the language learned earliest.

The English-unique-shared (R = .88) and Spanish-unique-shared (R = .81) variables were measures of the number of unique (uncommon) responses appearing as translation equivalents on both language protocols, the former based on the English (Russell-Jenkins) norms and the latter on the bilingual norms. The strength of the relationships is evident since 77% and 65%, respectively, of the variance in these dependent variables can be accounted for by variation in the seven predictor variables. The highest partial r's indicate that for both language behavior measures the earlier that good-premorbid, female Ss learned English, the more they gave the same unique responses in both languages.

The similarity of these results might be a function of the similarity existing between the two sets of norms, particularly at the primary and secondary response levels;

many responses were translation equivalents.[4] Schizophrenics are known to emit more uncommon associations than normals (see Footnote 1), so the unique responses themselves would be expected to relate to the psychiatric subcategories used as independent variables. In agreement with the commonality data, quick onset (good-premorbidity) of the schizophrenic condition tended to increase the response strength of otherwise low-probability unique responses.

In a different interpretation, the early first-use-of-English might establish relatively stronger speech habits in that language as a result of experience over time and recency of practice; the unique responses shared by both languages could be explained by the theory of intraverbal behavior as used to define translation (Skinner, 1957). A compound bilingual, as used in this study, might be expected to have acquired a set of translation intraverbal operants since he learned both languages in the same context. If the S functioned as both a speaker and a listener in both languages, then he might translate successfully by comparing the effects of the two versions on himself and modifying the translation until the effects were subjectively equivalent. Consequently, unique responses might be present in both language protocols as a reflection of the degree of translation skill possessed by the Ss. It seems possible that the good-premorbid status served to preserve this skill as it developed through use over time, and, therefore, to preserve the translation association hierarchies in the conceptual pattern analyzer (Figure 3).

English-Spanish confusions (R = .92) measured the frequency of responses to cross-language homonyms (e.g., soul-sol), responses which logically would indicate that English stimuli were detected acoustically as Spanish stimuli (e.g., ray-king, since "rey" is Spanish equivalent of "king"). The strong relationship between this linguistic variable and the predictors is obvious from the result that the independent variables accounted for 85% of the variance in the dependent variable. On the basis of the partial correlations, both good-premorbidity and nonparanoia were related to the occurrence of more confusions in stimulus discrimination, suggesting that these conditions affected the peripheral stimulus detection system of the psycholinguistic model (Figure 3).

The Spanish-English confusion variable (R = .69), a linguistic behavior variable similar to the one just described above, measured the frequency of detections of Spanish stimuli as English stimuli (e.g., lo-bajo). However, the independent variables accounted for only 48% of the variance, revealing that other factors were operating to produce the relationship that were not as influential on the English-Spanish counterpart. According to the partial correlations, the schizophrenic conditions were not as important to the strength of the relationship as was the first-use-of-English independent variable (r = -.32). The younger a S was when he first learned

English, the more he gave associations identified as Spanish-English confusions. Possibly those Ss who learned English early were more practiced in detecting stimuli in that language than in the language acquired somewhat later; therefore, the Spanish acoustical processor could be less reactive to ambiguous stimuli, and they might be processed as English stimuli. The overt response, however, might have been made in Spanish as a function of high-strength translation associations and/or an effective feedback system.

The English-Spanish translation variable (R = .99) yielded almost a perfect relationship with the predictor variables in that 99% of the variance in this language behavior variable was explained by variation in the seven predictors. The highest partial r's led to the statement that the younger a bilingual schizophrenic subject was when he first learned English, the more he responded with Spanish translations of English stimuli, and females gave more such responses than males. Additionally, first-use-of-Spanish and acuteness contributed some strength to the relationship, such that the older a subject was when he first used Spanish and the longer he remained in the hospital, the more he responded with English-Spanish translations.

It should be noted that these responses were given almost entirely by one female subject during one testing session, with one each given by two other subjects, thereby making generalizations virtually impossible. For the particular subject, however, it could be deduced that she was an active translator as a result of learning both Spanish and English in Mexico (where she was born), the former at home with her parents where it was established as her dominant language in childhood, and the latter in school. Later, after moving to California, she was a member of a Spanish-speaking family but gradually developed the skills necessary to function in an English-language culture. The explanation for her English-Spanish translation set, which occurred during the second English trial, could be attributed to non-task performance due to misunderstanding of the instructions. Alternately, one could speculate that more high-strength translation associations existed as the result of some recent Spanish-related experience. Several members of the hospital nursing staff had reported that the subject frequently had auditory hallucinations in Spanish. A more specific interpretation, in this case, of the strong inverse partial $\underline{r}$ for first-use-of-English might be that the early acquisition of English in a predominantly Spanish-speaking culture was related to more English-Spanish translation responses.

Spanish-English translations ($\underline{R} = .85$) were also strongly related to the predictor variables, with 73% of the variance in the dependent variable attributable to variation in the predictors. However, sex contributed the principal element, leading to the statement that females responded with more English translations when presented with Spanish stimulus words than males. The lack of interrelatedness with any particular psychiatric variable obviates any generalizations about the effects of the conditions on this measure of language behavior.

At this point it is logical to turn from a discussion of each dependent variable to a discussion organized in terms of the subject categories. Specifically, bilingual subjects classified according to premorbid status, paranoia, and chronicity can be compared on the measures of language performance derived from the word association test responses. Certain consistencies should be obvious from the relationships already described. Additional inferences can be made by characterizing each group with respect to differences in their mean number of responses on each dependent variable (Tables 2-20).

According to the partial _r_'s, goodness of premorbidity was negatively correlated with Spanish nouns and Spanish primary non-shared responses; it was positively correlated with English and Spanish multiword responses, English-unique-shared and Spanish-unique-shared responses, and English-Spanish confusions. There is further evidence of the relationships evident in the mean number of responses given by the poor-premorbids on these dependent variables. Poor-premorbid subjects gave more Spanish nouns (Table 6), more Spanish (bilingual) common responses not appearing in both language protocols (Table 13), and fewer English multiword

(Table 4) and Spanish multiword (Table 5) responses, fewer English unique (uncommon) and Spanish unique responses appearing in both language protocols (Tables 14 and 15, respectively), and fewer English-Spanish confusions (Table 16) than the good-premorbid subjects.

Since nouns occur more often than any other part of speech in the norm lists, these results indicate that this word type is more firmly established in the associational hierarchies as a consequence of learning primacy in the sequence of language development. Similarly, the advent of more Spanish primary non-shared responses would follow, since 53.3% of the primary responses are nouns on the bilingual norm list, whereas only 35.7% are nouns for the list of English equivalents used as stimuli.

From personal reports, five subjects learned Spanish before English, and five learned the two languages almost simultaneously. In light of these language histories, good-premorbid patients who learned Spanish at a later age would respond with fewer Spanish nouns and fewer Spanish primary non-shared associations than poor-premorbids, due to the fact that low-strength responses in their hierarchies would be increased in strength relative to the more common responses. Also, there would be more Spanish-unique-shared responses in the presence of fewer Spanish primary non-shared responses, since unique responses would be further from a response strength ceiling than high-strength associations which had been building up during the premorbid period. Where Spanish was learned early, the resulting language habits were reflected in the associational hierarchies which were developing during the same time period as the psycho-social maladjustments which led to the illness.

The good-premorbid condition, then, might be related to a malfunction in the conceptual pattern analyzer of the psycholinguistic model (Figure 3). The process would operate very close to the Broen and Storms model to increase the associational strength of responses occurring at the secondary level of the language processing system relative to those which were initiated simultaneously with the premorbid history.

Such an influence might also explain the increased Spanish and English multiword responses among good-premorbid subjects. Since multiword responses by definition consisted of more than one association, usually other parts of speech were involved, such as adjectives or verbs in a phrase. Therefore, if weaker associations were increased in strength, it might be expected that non-discrete associations were increased. A dysfunction in the conceptual pattern analyzer could have yielded both more Spanish and more English multiple-word responses due to the nature of the conceptual pattern analyzer; the hypothesized model functions in a unitary manner so that associations are stored in a common memory regardless of language.

A similar line of thinking might clarify the greater number of uncommon responses given in English for which the Spanish equivalents were given on the Spanish protocols. These English associations would be less firmly established in the conceptual pattern analyzer as a result of later English language acquisition and practice; thus, such low-strength associations would stand to gain more through a response association strengthening process.

The occurrence of fewer English-Spanish confusion responses among poor-premorbid subjects possibly reflected the effectiveness of the dual stimulus detection systems of the peripheral nervous system. At this primary level of the bilingual language processing mechanism, each processor is hypothesized to be functionally separate for a language, in this case English and Spanish. As measured by fewer confusions in the detection of English stimuli as Spanish stimuli by means of the cross-language homonym technique, it appeared that the English detection system remained intact, perhaps because it was the processor which operated for the more recently acquired language. It seems plausible that the poor-premorbid condition affected the subjects' ability to attend to the phonetic similarities of the two languages; these subjects processed ambiguous stimuli in terms of English, the language they used most consistently in daily communication. The English processor was more functional in the English test condition as a result of recency of usage. As additional support for this idea, the mean number of English-Spanish confusions was less for poor-premorbid than for good-premorbid subjects (see Table 16).

Although the partial r's did not demonstrate the converse relationship, that of poor-premorbid Ss emitting more Spanish-English confusions than good-premorbid Ss, the mean number of these responses was greater for the former group (see Table 17). This outcome could imply that the prolonged development of the illness was related to a defect, perhaps of an attentional nature, in the stimulus processor of the language learned first, so that the Spanish detection system was affected in the process of the schizophrenic onset. Since only 48% of the variance was explained by variation in the independent variables, possibly some additional mechanism was operating with the Spanish-English confusion variable which was present but which did not show up in the multiple R analysis.

As with good-premorbid subjects, nonparanoid subjects gave fewer Spanish nouns, more English and Spanish multiword responses, and more English-Spanish confusions than paranoid subjects. On the basis of the partial r's, then, both psychiatric subgroups are similarly related to language performance on these particular dependent variables. It would appear that both the nonparanoid and good-premorbid conditions are related to the same processes operating in the conceptual pattern analyzer and in the stimulus processor of the hypothetical psycholinguistic model (Figure 3).

It is suggested that nonparanoia may operate singularly or in combination with good-premorbidity to flatten the associational hierarchies. When Spanish was the language of the stimuli, Spanish nouns and discrete (as opposed to multi-word) responses in general logically would be high-strength associations, having been built up over time, and other responses would gain more strength relative to these, according to a Broen and Storms process.

Again, at the primary level of the bilingual language processing system, it would appear that the stimulus detectors are dual in nature and operate separately for each language. The occurrence of fewer English-Spanish confusion responses reflected less incorrect detections of the English stimuli (cross-language homonyms), implying that the English processor was not directly related to the effects of the paranoid state. Partial _r_'s did not yield a relationship with the Spanish-English confusion variable, but as with the premorbid classification, paranoids gave a greater mean number of these responses (see Table 17); it seems plausible that an unknown element, possibly an attentional factor, is related to functioning of the stimulus detection systems.

In contrast to these relationships common to both psychiatric conditions, nonparanoid subjects gave fewer Spanish-English cross-language-without-translations (with translation equivalents discounted) than did paranoid subjects.

This phenomenon is not what would be expected if the previous effects were due to a flattening of response hierarchies, suggesting that word associations in both languages are not normally stored in the same hierarchies.

The lack of relationships between paranoia and measures of response commonality suggests that this schizophrenic condition did not have a differential effect on the frequency with which a subject responded with the most common associations given by the norm groups. Paranoia, in contrast to premorbidity, was not functionally related to the response hierarchies existing in normals as reflected in the English and bilingual norms.

Acute subjects (hospitalized for less than 20 years) gave more Spanish primary non-shared responses and more English verb responses than did chronic subjects, contradictory results from the Broen and Storms perspective. In contrast to the poor-premorbid Ss, chronic Ss gave fewer common responses not shared by both language protocols based on the bilingual norms. To explain this outcome it is suggested that the longer the hospital confinement, the less contact the Ss had with the Spanish-speaking community and the more their English language habits were reinforced through daily use. Therefore, Spanish high-strength responses would diminish as a consequence of disuse in a predominantly English-language environment.

The inverse relationship with English verbs might be explained in terms of the essential elements necessary for communication within the hospital setting. In general, there is little activity which, therefore, would require the use of few "action words" even in the most frequently used language. Where there is minimal activity to refer to, it follows that references about activity also would be minimal. Furthermore, in regard to the English norms, verbs are usually low-strength associations anyway, and the restricted hospital environment would not seem to be conducive to strengthening them. As determined by observations of performance on the selected language behavior variables, it would appear that chronicity did not interact with the information processing system in the manner or to the extent that premorbidity and paranoia did.

The lack of obvious relationships with other dependent variables suggests that neither premorbid status, paranoia, nor chronicity was interacting sufficiently with the remaining measures of linguistic performance to reveal defects in the information processing system of the bilingual schizophrenic subjects tested. Although additional defects might exist, the method used in this study did not disclose the points at which they might be occurring, at least with respect to the specific psycholinguistic model which has been proposed.

As initially stated, the intent of this study was to investigate the influence of bilingualism on the verbal stimulus processing of schizophrenics. The word association technique revealed numerous relationships, as described above, between selected diagnostic classifications and language behavior variables in bilingual schizophrenic subjects. The nature of the subjects' responses on 19 measures of linguistic performance substantiated the prediction that the language production process represented by the psycholinguistic model of bilingualism (Figure 3) was influenced by the schizophrenic conditions at more than a single level. In general, malfunctions in the information processing system of bilingual schizophrenics seemed to occur at the primary and secondary levels of the stimulus detection system and conceptual pattern analyzer, respectively. The measures of verbal performance taken did not clearly reveal malfunctions at the tertiary level, where the hypothetical motor effector system of the response organizer produces the overt speech behavior patterns.

On the basis of the evidence collected, the primary level stimulus processor appears to be functionally separate for each language. When presented with an English word that has the same phonetic characteristics as a Spanish word (e.g., "floor" is pronounced similarly to "flor"), the good-premorbid and nonparanoid subjects displayed confusion in responding within the context of the English sound system. This phenomenon could indicate that they were experiencing an attentional deficit which affected selection of the appropriate stimulus processor unit. Such an interpretation could be construed as support for an attentional deficit theory of schizophrenic etiology (Cromwell & Dokecki, 1968; Lawson, McGhie, & Chapman, 1964).

It seems plausible that the English stimulus processor was more often utilized because of the general sequence of language acquisition in the bilingual subjects. Since English was usually learned as the second language, it was less likely to have developed contemporaneously with the early poor-premorbid history. Although not supported by empirical results, a logical extension of this reasoning might lead to the hypothesis of a decline in selection of the processor of the language learned earliest (Spanish), since it would have evolved concomitantly with the illness. Further testing with the cross-language homonym technique or with less complex stimuli, such as phonemes (the minimum contrasting units of a sound system which can change one word into another), might reveal more obvious differential functioning at this primary level of the psycholinguistic model (Figure 3).

By far the most well-defined effects of the psychiatric syndrome occurred at the secondary level of the bilingual language production system, referred to in the model as the conceptual pattern analyzer (Figure 3). At this level, the semantic aspect of the language is added to the signal pattern transmitted from the sensory processors. In contrast to the dual stimulus processors, this analyzer seems to operate as a single unit with a common memory irrespective of the specific language; this assumption seems logical due to the fact that most of the subjects were compound rather than coordinate bilinguals and would be expected to share common elements in their memories as a result of equivalent experiences in both languages.

On the basis of evidence cited above, the proposed numerous associational hierarchies which constitute the conceptual pattern analyzer were effectively flattened when interacting with the schizophrenic diagnostic classifications, particularly premorbidity and paranoia. These conditions, in conjunction with the observed measures of language behavior, identified malfunctions characterized by flattening the associational structures so that the low-strength associations were enhanced, and the variety of possible responses was increased. Good-premorbidity and nonparanoia were associated with reduced Spanish primary and noun responses (which had been developing since childhood), perhaps reflecting interference of low-strength responses. Beyond this result, the diagnostic groupings did not have a clear effect on response commonality in either language. As a final observation, even though there was less statistical support, relationships between acuteness and bilingual language behavior pointed ambiguously in the direction of flattening the associational structures.

The greatest single deficiency in this study is the small sample size which resulted from the specialized characteristics required of the subjects by virtue of the definition of the problem. Because schizophrenic patients who were bilingual in Spanish and English were not readily obtainable, it was virtually impossible to control for such variables as education, type of bilingualism, and experience with each language. Any patient with a schizophrenic diagnosis who could speak and understand both Spanish and English and who was willing to participate was selected as a subject. It was necessary to rely on the subjects' memories and verbal reports for information about language acquisition history. Gaps in their psychiatric case histories were filled in by means of inference, deduction, and speculation on existing details, so that the scores on the Phillips scale were sometimes imprecise. Since four of the original 13 subjects were not hospitalized at the time of testing, their acute-chronic status was necessarily based on the duration of their most recent confinement prior to release; this discrepency made a comparison of their chronicity with that of the currently hospitalized subjects difficult.

Another problem concerned the choice of stimuli, particularly in attempting to select commonly known translation equivalents in the two languages. Unfortunately, dictionary translations, although correct, often do not denote the same referent, nor are they equally familiar to all Spanish-speaking people in all geographical areas. As a result, occasionally a subject did not have any semantic basis for responding to a word because he did not know it. Based on such revelations, the experimenter would make some modifications in the stimulus list for future use in a bilingual word association task.

The fact that not all subjects were tested in the same environment made it difficult to hold test conditions constant, especially with respect to the comfort of the surroundings and the maintenance of the language set. In the Spanish test condition, subjects who interacted with English-speaking people, including the research assistant, obviously had the language set for that trial interrupted.

In regard to the actual test administration, mechanical problems with the tape recorder in early trials led the experimenter to modify his technique for presenting the stimuli in subsequent trials with other subjects. To the extent that the experimenter's vocal repetition of a subject's response to a given word in order to clarify it for recording purposes would influence the subject's response to the next word, then approximately half of the subjects' associations were so affected. This technique should be standardized for future studies. Also, the order of presentation of the language of the stimuli, either Spanish or English, probably would better be counterbalanced than alternated. In order to avoid misunderstandings of task performance, and, thus, the necessity for excluding subjects, word association test instructions should emphasize the undesirability of translation equivalents as acceptable responses.

Given the results of this study and the relationships which were found to exist between bilingual language behavior and schizophrenia, it is recommended that further research be directed at the selection of dependent variables in light of specific hypotheses about the language production system. By defining the language behavior variables prior to the execution of the experiment, more specific hypotheses could be formulated and tested . A logical continuation of the present study would be to compare the word association responses of normal bilinguals to those of schizophrenic bilinguals on the same measures of linguistic performance taken for this project. Another possibility would be to compare the responses of schizophrenics to other psychiatric groups. As stated in the introduction, it is intended that research relating language phenomena and verbal behavior, in particular, to the cognitive processes operating in psychopathology could lead to important insights about the nature of normal language skills, processing, and organization.

Summary

In light of modern psycholinguistic research and theory this study investigated the relationships obtaining between the schizophrenic categories of premorbidity, paranoia, and chronicity and 19 measures of linguistic behavior in bilingual schizophrenic patients. Thirteen Spanish-English bilingual schizophrenic subjects, classified according to psychiatric status, language acquisition history, age, and sex, were given an oral-aural word association test in equivalent Spanish and English versions. When two subjects who perseverated with Spanish-to-English translation responses were discounted from the analysis, the results yielded 19 multiple R values greater than .50, indicating substantial relationships between the schizophrenic and demographic variables and language performance. On the basis of a hypothetical model of bilingualism, these findings were construed as evidence of defects in the language processing system of bilingual schizophrenics at the primary level of stimulus detection and at the secondary level of conceptual pattern analysis involving associational hierarchies. It is suggested that the schizophrenic conditions interacted with the language processing system to flatten the associational structures and increase the range of overt speech behavior, possibly in one or both languages.

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Footnotes

[1]In general the word associations of schizophrenics are more unique, idiosyncratic, and uncommon than those of normals (Lang & Buss, 1965; Pavy, 1968; Sommer, Dewar, & Osmond, 1960; Storms, Broen, & Levin, 1967). Kolers (1963) found that bilinguals gave a low proportion of similar-meaning or shared responses to translation equivalents; this finding led the author to conclude that verbal memories are not stored separately in the language S used to define the experience to himself [p. 300]." This conclusion could be interpreted in terms of the associational structure theory detailed above; possibly the translation equivalents did not tap separate language memories, but instead evoked the high-strength responses from the sets of associations built up for each stimulus, regardless of the stimulus language.

[2]Entwisle (1966) noted that there was virtually no distinction in frequency of occurrence between high- and medium-frequency nouns for adults, as demonstrated by a comparison of the Thorndike-Lorge J- and G-counts (p. 22).

[3]The experimenter and E. García, a Spanish-speaking student at the University of the Pacific, collected a set of normative responses from Spanish-English bilingual high school and college students in the Stockton area. Evidence of their performance as Spanish-English bilinguals was based on their willingness and ability to respond in writing in either language to a 100-item Spanish translation of the Kent-Rosanoff Word Association Test ($N \approx 100$).

[4]Similarly, Rosensweig (1961) reported that comparisons among primary responses to the English Kent-Rosanoff list and to its translations in French, German, and Italian revealed that the greater the frequency with which a particular primary response was given, the more likely was that response to agree in meaning with the corresponding primary responses in the other languages. These results led the author to the assumption that similar associations tend to occur among words of similar meanings, regardless of the particular language form.

Appendix 1

Phillips Scale

I. Pre-Morbid History

A. Recent Sexual Adjustment

1. Stable heterosexual relation and marriage 0
2. Continued heterosexual relation and marriage but unable to establish home 1
3. Continued heterosexual relation and marriage broken by permanent separation 2
4. (a) Continued heterosexual relation and marriage but with low sexual drive 3
   (b) Continued heterosexual relation with deep emotional meaning but emotionally unable to develop it into marriage 3
5. (a) Casual but continued heterosexual relations, i.e., "affairs," but nothing more 4
   (b) Homosexual contacts with lack of or chronic failure in heterosexual experiences 4
6. (a) Occasional casual heterosexual or homosexual experience with no deep emotional bond 5
   (b) Solitary masturbation with no active attempt at homosexual or heterosexual experiences . . 5
7. No sexual interest in either men or women 6

B. Social Aspects of Sexual Life During Adolescence and Immediately Beyond

1. Always showed a healthy interest in girls with a steady girl friend during adolescence 0
2. Started taking girls out regularly in adolescence 1
3. Always mixed closely with boys and girls 2
4. Consistent deep interest in male attachments with restricted or no interest in girls 3
5. (a) Casual male attachments with inadequate attempts at adjustment to going out with girls 4
   (b) Casual contacts with boys and girls 4
6. (a) Casual contacts with boys and with lack of interest in girls 5
   (b) Occasional contacts with girls 5
7. No desire to be with boys and girls; never went out with girls 6

C. Social Aspects of Recent Sexual Life: 30 years of Age and Above

1. Married and has children, living as a family unit 0
2. Married and has children but unable to establish or maintain a family home 1
3. Has been married and had children but permanently separated 2
4. (a) Married but considerable marital discord . . 3
   (b) Single, but has had engagement or deep heterosexual relationship but emotionally unable to carry it through to marriage . . . 3
5. Single, with short engagements or relationships with women which do not appear to have had much emotional depth for both partners, i.e., "affairs" 4
6. (a) Single, has gone out with a few girls but without other indications of a continuous interest in women 5
   (b) Single, consistent deep interest in male attachments, no interest in women 5
7. (a) Single, occasional male contacts, no interest in women 6
   (b) Single, interested in neither men nor women . 6

D. Social Aspects of Recent Sexual Life: Below 30 years of Age

1. Married living as family unit, with or without children 0
2. (a) Married, with or without children, but unable to establish or maintain a family home . . . 1
   (b) Single but engaged or in a deep heterosexual relationship (presumably leading toward marriage) 1
3. Single, has had engagement or deep heterosexual relationship but has emotionally been unable to carry it through to marriage 2
4. Single, consistent deep interest in male attachments, with restricted or lack of interest in women 3
5. Single, casual male relationships with restricted or lack of interest in women 4
6. Single, has gone out with a few girls casually but without other indications of a continuous interest in women 5
7. (a) Single, never interested in or never associated with either men or women 6
   (b) Antisocial 6

E. Personal Relations: History

1. Always has had a number of close friends but did not habitually play a leading role 1
2. From adolescence on had a few close friends . . . 3
3. From adolescence on had a few casual friends . . 3
4. From adolescence on stopped having friends . . . 4
5. (a) No intimate friends after childhood 5
   (b) Casual but never any deep intimate mutual friendships 5
6. Never worried about boys or girls; no desire to be with boys and girls 6

F. Recent Premorbid Adjustment in Personal Relations

1. Habitually mixed with others, but not a leader . 1
2. Mixed only with a close friend or group of friends 3
3. No close friends; very few friends; had friends but never quite accepted by them 4
4. Quiet; aloof; seclusive; preferred to be by self 5
5. Antisocial 6

(Note.--Scale reproduced from an article by L. Phillips, _Journal of Nervous and Mental Diseases_, 1953, _117_, pp. 515-25.)

Appendix 2

Stimulus Words

(1)	long	largo
	scissors	tijeras
	lamp	lámpara
	table	mesa
	boy	muchacho
	dark	oscuro
	butter	mantequilla
	slow	despacio
	high	alto
	eagle	águila
	bed	cama
	tobacco	tabaco
	man	hombre
	heavy	pesado
	sour	agrio
	hammer	martillo
	hard	duro
	black	negro
	bread	pan
	bitter	amargo
(2)	cold	frío
	color	color
	bird	pájaro
	river	río
(3)	music	música
	yellow	amarillo
	fruit	fruta
	loud	ruidoso

(4)	light	luz
	loose	suelto
	king	rey
	ray	rayo
	blossom	flor
	floor	piso
	with	con
	cone	cono
	sun	sol
	soul	alma
	law	ley
	lay	poner
	net	red
	red	rojo
	thousand	mil
	meal	comida
	thirst	sed
	said	dijo
	of	de
	day	día
	me	me
	May	mayo
	yes	sí
	sea	mar
	you	tú
	two	dos
	it	lo
	low	bajo
	neither	ni
	knee	rodilla
	for	por
	pour	vaciar
	without	sin
	scene	escena

Appendix 3

Language Acquisition History Questionnaire

Subject Number ______________________________

Age ______________________________

Male ____________ Female ____________

Date ______________________________

1. Is a language other than English spoken regularly in your home? ______________________________
2. Is your native language other than English? ______
3. How old were you when you learned English? ______
4. How old were you when you learned Spanish? ______

Número del Sujeto ______________________________

Edad ______________________________

Hombre ____________ Mujer ____________

Fecha ______________________________

1. ¿Se habla un idioma que no sea inglés regularmente en su casa? ______________________________
2. ¿Es su lengua nativa el español? ______
3. ¿Cuántos años tenía cuando aprendió inglés? ______
4. ¿Cuántos años tenía cuando aprendió español? ______

Appendix 4

Word Association Test Instructions

This is a study in word association. We would like your help to find out more about how your thoughts relate to how you use language. You are going to have a test to see how quickly you can think of words.

You will hear a list of words spoken at about 15-second intervals. After each word, you are asked to respond with the first single word that comes to mind other than the word I say. I will use this tape recorder to record your responses, and you will be timed. Later, after I listen to the tape I will write down your responses on an answer sheet, but right now we'll just talk. Remember, respond as quickly as you can with the first word you think of other than the word you hear. For example, if I say "dog," you might say "cat." Or, if I say "window," you might say "glass."

Let's try a couple for practice:

night ______________

lion ______________

Good. Do you understand? Do you have any questions?

Remember, there is no pattern of correct answers. Just give the first response that comes to mind as quickly as you can. Ready? Let's begin.

Esta es una investigación de la asociación de palabras. Nos gustaría su ayuda para entender más de la relación entre sus pensamientos y cómo usa el idioma. Tendrá una prueba para determinar la rapidez con que puede pensar de palabras.

Va a oír una lista de palabras, una palabra cada quince segundos. Al oír cada palabra, dígame la primera palabra única que se le ocurra más que la misma palabra que yo digo. Tomo el tiempo de sus respuestas y voy a grabarlas de cinta con esta grabadora. Más tarde, después que escucho a la cinta, escribiré las respuestas en papel, pero ahora solamente hablamos. No se olvide, conteste lo más pronto posible con la primera palabra de que piense. Por ejemplo, si yo digo "perro," es posible que responda con "gato." O si digo "ventana," posiblemente pueda responder "vidrio."

Vamos a probar unos para practicar:

noche ______________

león ______________

Bueno, ¿entiende? ¿Hay preguntas?

Recuerde que ninguna palabra es correcta o incorrecta; solamente conteste con la primera palabra que piense. ¿Listo? Vamos a empezar.